Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

THE TURKEY AS A SUBJECT FOR EXPERIMENT

EXPERIMENTS with our native vertebrates offer many difficulties not encountered when dealing with domestic animals. In the field of genetics especially, while domestic animals continue to furnish enticing problems, it is not strange, therefore, that they practically monopolize the attention of students. No one can foresee how far work of this kind will proceed but it seems probable that some important phases of the subject of variation never can be elucidated by the study of domestic animals alone. Hence it would be very desirable to work with wild forms wherever this is practicable. This would be especially interesting for study of the significance of the intergrading subspecies or ''geographic race'' which is found so widely in nature but which appears to have no recognizable counterpart in the ordinary variations of domestic animals.

The so-called subspecies perhaps needs no introduction even to biologists who do not have first-hand acquaintance with it, but the extent to which it features in the fauna of the world seems scarcely realized even among those who are quite familiar with it. Within the memory of the present generation, the ultimate division of classification was the species and attempts to divide this into races or varieties were often looked at askance as probably indicating an over-weening desire to multiply names and magnify differences of no phylogenetic significance. In wrestling with the question ''What is a species?'' many were led to eschew classification entirely and contented themselves with the knowledge that no two individuals were alike and the belief that efforts to associate them were futile. Meanwhile, in spite of headshaking in various quarters, ''hair-splitting'' has continued until at present nothing is clearer than that the subspecies is a reality constituting a widespread and obvious evidence of active contemporary change in organisms, not only in single individuals but in groups of individuals.

In ornithology and in mammalogy, at least, the old-fashioned species in the vast majority of cases is found to be a composite or a mosaic definitely divisible into units connected by graded series and having a plain relation to geographic distribution. A species of continental distribution in North America, for example, may have one subspecies in the east, one in the north and several in the south and west each occupying a limitable area and each characterized throughout its range by certain features not possessed by the others. Along the geographic borders of each subspecies will be found specimens showing varying degrees of intergradation so that each form merges with an adjoining one, or, in some cases, one in central position may merge into several others in different directions. If, for any reason, the "areas of intergradation" were rendered uninhabitable, the various subspecies would stand as distinct well-characterized forms presumably until they themselves began to differentiate and separate into parts. Sometimes the difference between recognizable subspecies is slight, or sometimes it is very marked, but when gradations through several forms are followed, characters are almost always found to change to a degree far beyond any probability of an ontogenetic explanation. It may be emphasized that subspecies of this sort are not the exception, but the rule. It might almost be said that the existence of diverse inosculating units correlated with geography is characteristic of terrestrial vertebrates. Continued study with improved facilities and increasingly comprehensive collections from all parts of the world constantly reduces the number of forms which are not known to break up into subspecies. To a very great extent, the presence of an undivided 'full species'' in our check-lists signifies either that it is a senescent type of limited distribution or that, for lack of material or opportunity, it has not been studied intensively. The intergrading subspecies has not been recognized so widely among invertebrates nor in plants, but neither entomologists nor botanists have collected and studied their material from the geographic standpoint to such an extent as the ornithologists and mammalogists, so it cannot be said that the process of change illustrated by the subspecies is not even more widespread than appears from the study of birds and mammals.

The process of formation of these subspecies, therefore, is going on before our very eyes in wholesale fashion and it is difficult to believe that it is, as someone has said, merely a "shuffling of the cards" which in the long run means nothing to evolutionary progress. Rather does it seem that it must have a physiological basis, a relation to germinal change, and a large potentiality for affecting the general course of evolution. Despite its evident importance, the intergrading subspecies is receiving but scant attention from experimental zoologists. With the conspicuous exception of the very significant work being done with white-footed mice by Dr. F. B. Sumner of the Scripps Institution,[1] there seems to be little or no work under way which can be correlated logically with the results of speciation and subspeciation as the field naturalist and taxonomist find them in nature. Doubtless one of the principal reasons for this is the difficulty of finding convenient subjects and suitable conditions for such work. Perhaps another is the independence of workers in the respective fields of taxonomy and experimental zoology.

As promising subjects for experiment, it seems worth while to call attention to the American wild and domestic turkeys. The common turkey has an exceedingly desirable distinction from other domestic animals in that there is no important question as to its history and lineage. Moreover, the wild stock from which it was derived represents one of several intergrading subspecies the natural characters and relationships of which can be determined with a great degree of accuracy. Hence our Thanksgiving bird, as a subject for experimental breeding, might furnish a combination with which naturally and artificially induced characters could be studied comparatively. As at present recognized and understood, the native American turkey is divisible into six races or subspecies, as follows: One from the southeastern United States (*Meleagris gallopavo sylvestris*); one from southern Florida (*M. g. osceola*); one from central Texas and northeastern Mexico (*M. g. intermedia*); one from Arizona, New Mexico and Chihuahua (*M. g. merriami*); one from the Sierra Madre of Jalisco and west central Mexico (*M. g. mexicana*); and one from the eastern cordillera of Vera Cruz, Mexico (*M. g. gallopavo*). The range of the turkey group is thus from the southeastern Atlantic seaboard westward to the Rocky Mountains and thence south to Vera Cruz. Complete intergradation between the various subspecies may not be demonstrable with absolute nicety in all cases because the birds were exterminated in certain parts of the range before any specimens were preserved. That intergradation between all the races was as uninterrupted as it can be shown to be between some of them, however, is beyond reasonable doubt. The extremes of differentiation, as usual in such cases, are represented approximately by the geographical extremes. The characters distinguishing the wild turkey of the eastern United States from that of southern Mexico, therefore, are clear cut and readily recognizable without the application of any greatly refined methods. The obvious distinction is found in the feathers of the tail and upper tail coverts which in the United States bird are broadly tipped with rich chestnut whereas in the Mexican subspecies these parts are white or nearly white. Such characters, in animals of unknown history, might easily be looked upon as produced by mutation; but with complete gradation from one to the other known to exist in nature, it is hard, at least for some of us, to believe that the difference was not accomplished by gradual rather than sudden change. If it could be shown that characters of this kind behave as hereditary units without any such blending as requires "dialectic gymnastics" to explain, it would be a long step forward in the correlation of natural and man-made experiments. Such characters are in fact heritable, as has been shown by Sumner in his breeding and transference experiments with *Peromyscus*. This is illustrated also by an undirected experiment to call attention to which is one of the objects of this communication, namely, the test of subspecific characters which has been carried out in the domestication of the turkey.

---

[1] See especially AM. NATURALIST, XLIX, pp. 688–701; *ibid.*, LII, pp. 177–454, 1918.

As is widely known to sportsmen, breeders, and many others, our domestic, so-called bronze, turkey is readily distinguished from the wild bird of the eastern United States by the coloration of the upper tail coverts and tail. The reason for this, which is not so generally known, is not that the domestic bird has changed in these respects under man's influence, but because it is the direct descendant of the Mexican wild race which differs from the northeastern race by these selfsame characters. Carried from Mexico to Europe in the early sixteenth century and thence brought to the United States, it has continued for more than three hundred generations in a new environment maintaining its old established subspecific characters. To-day it may differ from the Mexican wild race in some details, but its general coloration is the same and especially does it retain its taxonomically diagnostic features. These, therefore, are heritable and doubtless related to germinal conditions which became fixed in the wild bird. Since the characters themselves are of the kind that appear to be produced by insensible gradations and of the kind that frequently bear an obvious relation to environment, an easy deduction would be that the germ plasm also has changed gradually and, at least as a working hypothesis, one might suppose that the germ plasm had been affected directly or indirectly by the environment. Such an explanation is, of course, far too simple and old-fashioned for present-day students of evolution. It does not explain a multitude of undeniably important and fascinating results of experimental work. But neither do theories of mutation and the maze of modern genetics explain the intergrading subspecies and perhaps there is room for at least a little experimental work which does not deny such an hypothesis at the outset.

In the case of the turkey, while the relatively inconspicuous subspecific character has proved itself stable, violent saltatory changes have been established easily. These are of the sort common among close bred domesticated animals but so rare among wild vertebrates that no one has yet found a case in which they can be shown to have been perpetuated by natural process. Thus we now have self-colored breeds of turkeys respectively black, white, buff, and blue gray as well as the breed called Narragansett in which the feathers are tipped with steel gray. Hence it seems that the turkey may offer an opportunity for comparative study of the hereditary behavior of characters which have developed naturally by what seems to be continuous variation and those which have appeared discontinuously and been perpetuated artificially. Sumner (l. c., 1918) has found with *Peromyscus* that hybridization of different subspecies produces in the F_1 and F_2 generations a blending of the subspecific characters comparable to the gradations found in nature, whereas mutant characters (partial albinism, etc.) act as simple Mendelian units. In other words, natural subspecific characters act in hybridization experiments as they would be expected to do on the assumption that they were produced by continuous variation. Whether or not the same results would follow with the turkey and other forms would seem to be well worth determining. In a general way, it is known to breeders that hybrids between wild and domestic turkeys are of intermediate type, but so far as I know careful well-controlled work has not been done.

WILFRED H. OSGOOD

FIELD MUSEUM OF NATURAL HISTORY